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POPULATION GENETICS OF THE RED CELL
ACID PHOSPHATASE

G. Radam and H. Strauch

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POPULATION GENETICS OF THE RED CELL
ACID PHOSPHATASE

By

G. Radam and H. Strauch

ABSTRACT: Gene frequencies of red cell acid phosphatase have been determined in a random sample of 1188 adults of the environs of Berlin, as well as in a sample of 65 individuals from North Vietnam. The probability of exoneration, with use of the erythrocyte phosphatase test in a paternity lawsuit, amounts to 24.6% for the German population.

Introduction

According to investigations of Hopkinson, Spencer, and Harris, and later Lai, Nevo and Steinberg, on different populations, the six hitherto observed phenotypes of the red cell acid phosphatase are controlled by three allele codominant genes (Pa, Pb, Pc). Table I shows the distribution found by the authors. Type C could at first not be observed by Hopkinson et al. Its frequency was estimated by then to be 1:600. Lai et al. found it once for two children, whose parents belonged to type BC.

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TABLE I

Hopkinson et al. (1964)					Lai et al. (1964)			
Phenotype 367 English			140 Residents of Tristan da Cunha		23 Negros	369 Brazilians		
A	41	0.112	2	0.014	1	0.05	15	0.041
AB	175	0.477	20	0.143	7	0.30	111	0.301
B	123	0.335	118	0.843	15	0.65	220	0.596
AC	9	0.025	0	0	0	0	4	0.011
BC	19	0.052	0	0	0	0	19	0.051
C	0	0	0	0	0	0	0	0

*Numbers in margin indicate pagination in foreign text.

Investigations

By means of a technique described by us (see below) we investigated the distribution of the phenotypes on 1188 adults in Berlin and environs. The result is summarized in Table 2. We further had the opportunity of determining the phosphatase type of 65 North Vietnamese (Table 3). The gene frequencies that we calculated are compared in Table 4 with the figures known from the literature.

The type distribution in the English and German populations is not significantly different, while the comparison of the Brazilian and the Vietnamese random samples show significant deviations from the German according to the χ^2 method ($P = 1\%$).

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TABLE 2

DISTRIBUTION OF THE PHENOTYPES OF THE RED CELL ACID PHOSPHATASE IN BERLIN AND ENVIRONS

Phenotype	Genotype	Found		Expected	
A	pa/pa	145	0.1221	155.9	0.1313
AB	pa/pb	516	0.4343	496.4	0.4179
B	pb/pb	387	0.3258	393.9	0.3325
AC	pa/pc	55	0.0463	52.5	0.0442
BC	pb/pc	80	0.0673	83.5	0.0704
C	pc/pc	5	0.0042	4.4	0.0037
Sum		1188	1.0000	1187.6	1.0000

TABLE 3

PHOSPHATASE TYPES OF 65 ADULT NORTH VIETNAMESE

Phenotype	Found		Expected	
A	5	0.077	4.4	0.068
AB	24	0.369	25.1	0.386
B	36	0.554	35.4	0.546
AC	-	-	-	-
BC	-	-	-	-
C	-	-	-	-
Sum	65	1.000	64.9	1.000

TABLE 4
GENE FREQUENCY OF THE PHOSPHATASE TYPES

	Hopkinson et al.				Lai et al.	
	Berlin Material (n - 1188)	North Vietna- mese (n = 65)	English (n = 367)	Residents of Tristan de Cunha (n = 140)	Negroes (n = 23)	Brazilian (n = 369)
pa	0.362	0.26	0.36	0.09	0.2	0.197
pb	0.577	0.74	0.60	0.91	0.8	0.772
pc	0.061	0	0.04	0	0	0.031

The usefulness of the phosphatase system for appraisal of paternity has already been confirmed (Prokop, Randam and Strauch 1966). According to the calculations of J. Maege, I. Physicotechnical Institute of the German Academy of Sciences at Berlin, 24.6% of all those who were wrongfully accused of paternity could be exonerated by means of this system alone. The probability of exoneration was determined on a random sample comprising 1043 adult persons of the German population and represents the sum of individual probabilities for all probability constellations with consideration of the binomial distribution.

Methology

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Horizontal starch gel electrophoresis 15 hours at 5°C and 5 volt/cm. Gel measurements 22 X 7 X 0.7 cm. Gel buffer: 0.012 molar phosphate buffer pH = 6.0. Bridge solution: 0.4 molar citrate buffer (Anode), 0.1 molar citrate buffer (cathode), pH = 6.0. Material of investigation hemolysate in Whatman filter paper No. 17. Preparation of enzyme zones according to Hopkinson et al. Figure 1 shows schematically the electrophoresis apparatus used by us. Figure 2 shows the isolated pictures of the phosphatase types without the fast wandering additional fractions (compare with this Random and Strauch 1966b). We have given further details of the method in a previous article (1966a).

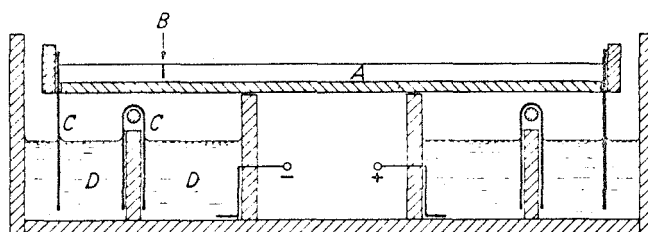


Figure 1. Electrophoresis Arrangement (Schematic)
Scale 1:3, A. starch gel, B. position of the starting slot, C. blotting paper; D. bridge buffer.

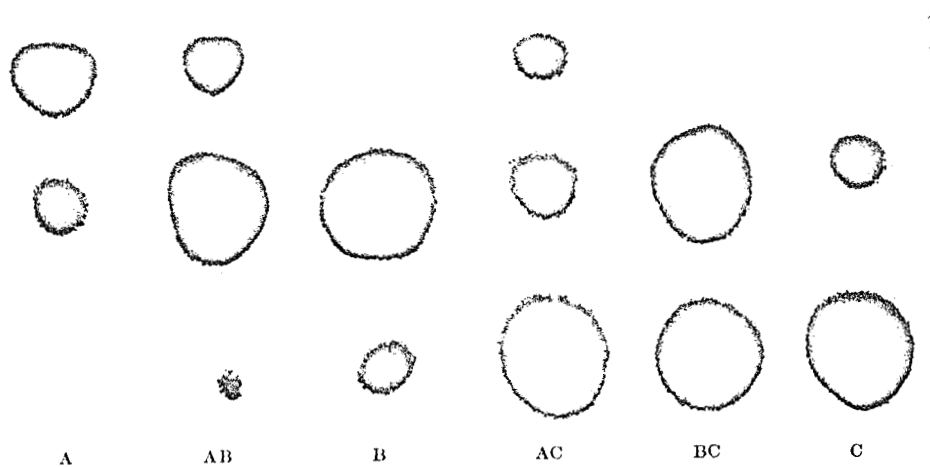


Figure 2. Types of Acid Erythrocyte Phosphatase
After Separation in the Starch gel.

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